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(71) Applicants

BP Chemicals Limited

(Incorporated in United Kingdom)

**Belgrave House, 76 Buckingham Palace Road,
London, SW1W 0SU**

Nokia Corporation

(Incorporated in Finland)

P O Box 33, 00441 Helsinki, Finland

(72) Inventors

Antti Tapani Mattila

James Elliott Robinson

Jeffrey David Umpleby

(51) INT CL⁴

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(74) Agent and/or Address for Service

R R Hymers

BP International Limited,

Patents & Agreements Division, Chertsey Road,

Sunbury-on-Thames, Middlesex, TW16 7LN

(54) **Process for producing a shaped, extruded product from a crosslinkable polymeric composition**

(57) The process comprises:

(A) introducing into the feed zone of an extruder a copolymer of an alpha-olefin with a hydrolysable, unsaturated silane compound;

(B) compacting and melting the copolymer in the extruder;

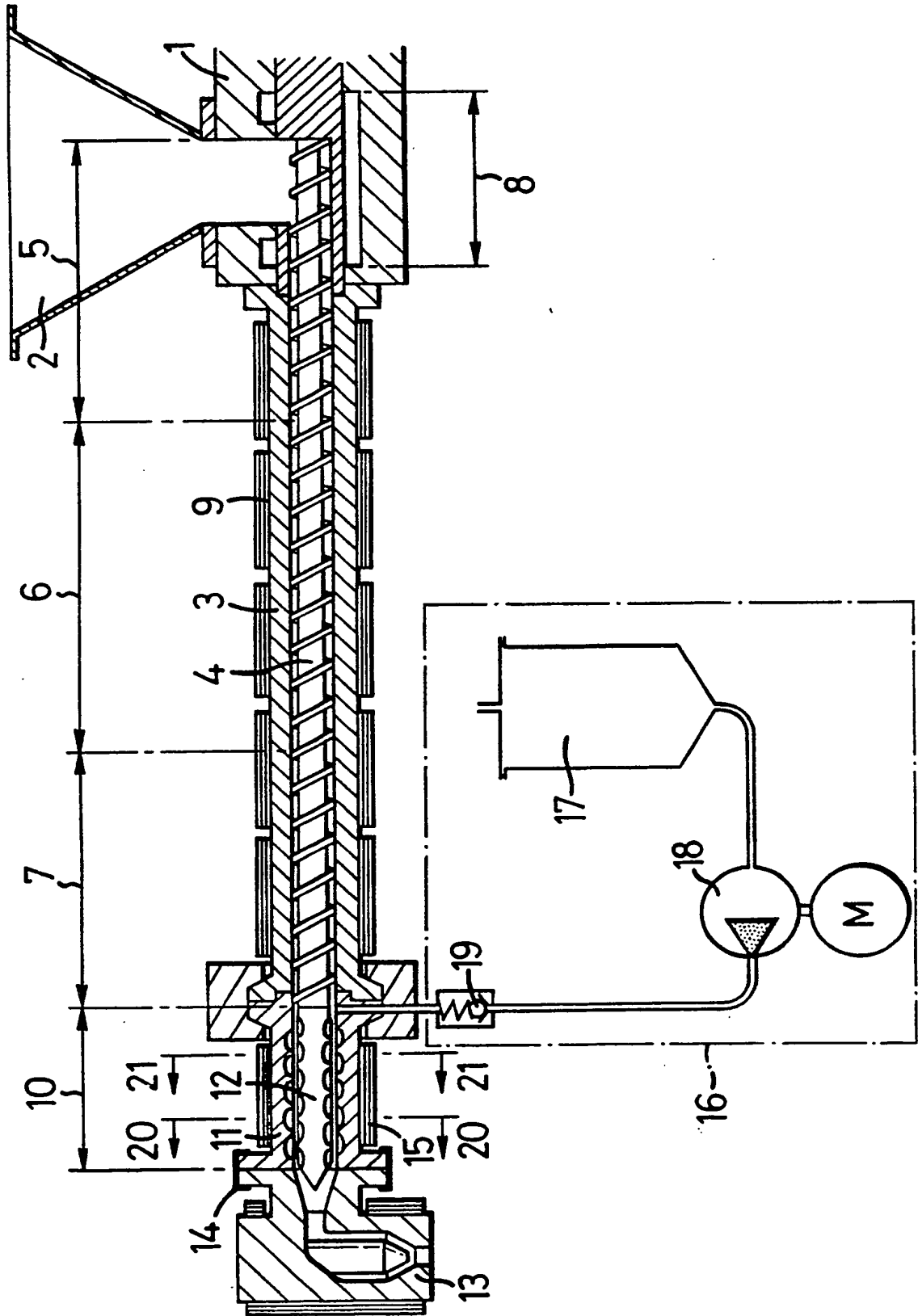
(C) passing the compacted, molten copolymer through a distributive mixer positioned at the discharge end of the extruder;

(D) injecting a silanol condensation catalyst into the compacted, molten copolymer after compacting and melting in the extruder;

(E) blending the compacted, molten copolymer and the silanol condensation catalyst in the distributive mixer, and

(F) extruding the resulting blend out of the distributive mixer through an extrusion die to form a shaped, crosslinkable, extruded product.

The distributive mixer is preferably a cavity transfer mixer. The process which is particularly useful for coating wires and cables overcomes, or at least mitigates, the problem of precuring of the thermoformed copolymer.



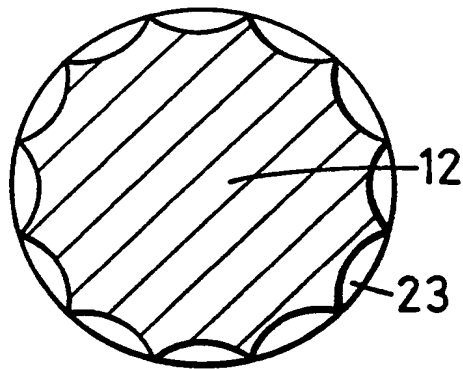


FIG. 2

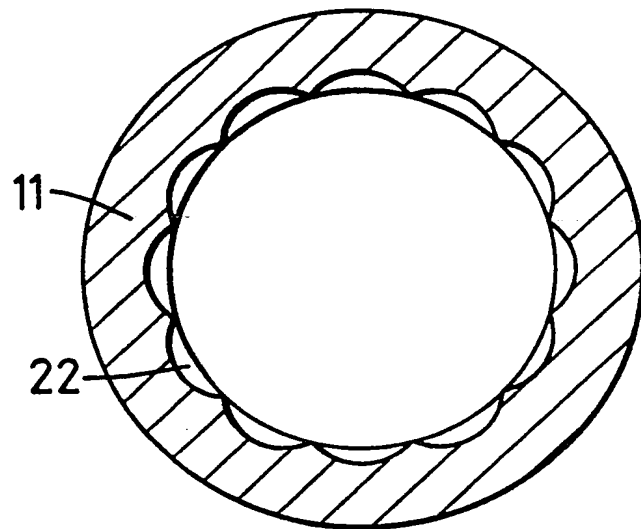


FIG. 3

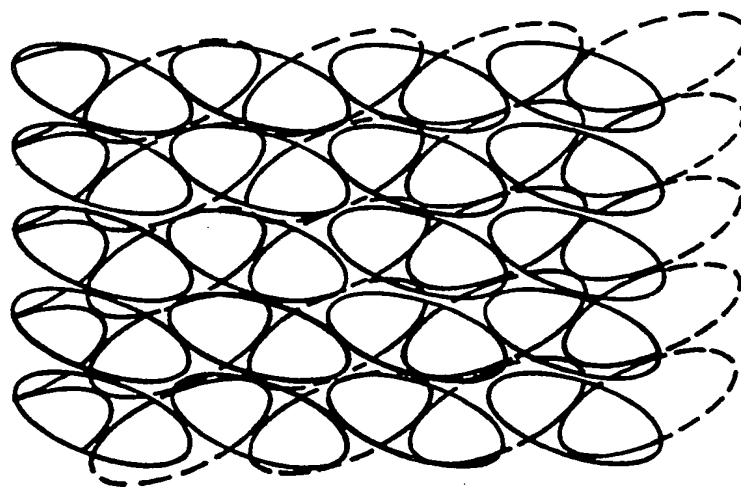


FIG. 4

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PROCESS FOR PRODUCING A SHAPED, EXTRUDED PRODUCT FROM A
CROSSLINKABLE POLYMERIC COMPOSITION

The present invention relates to a process for producing a shaped, extruded product from a crosslinkable composition comprising a copolymer of an alpha-olefin with a hydrolysable ethylenically unsaturated silane compound. In particular, the invention relates
5 to a method for producing coated electric wire and cable from copolymers of ethylene.

It is well known that polymer compositions can be thermoformed by extrusion into a variety of useful articles such as pipe and coatings for electric wire and cable. For some applications the
10 polymer compositions are not crosslinked, but for others, especially wire and cable insulation, the polymer compositions are crosslinked. Crosslinking the polymer composition improves the physical properties, particularly the high temperature properties.

A number of methods for crosslinking a polyolefin are known.
15 For example, the polymer can be irradiated to cause crosslinking or an organic peroxide can be mixed with the polymer and then the mixture heated to decompose the peroxide. The irradiation technique requires special, expensive equipment and is not suitable for crosslinking thick sections of polymer. The use of organic
20 peroxides can result in the generation of bubbles in the polymer due to decomposition gases.

Another method of crosslinking a polyolefin is to incorporate into the polymer hydrolysable silane groups which form crosslinks by hydrolysis and condensation in the presence of water.

25 US Patent 3 075 948 discloses the production of graft

copolymers of polyolefins, such as polyethylene, and hydrolysable ethylenically unsaturated silanes in the presence of a solvent, such as xylene and catalysed using a peroxide or hydroperoxide.

5 US Patent 3 646 155 discloses the production of shaped crosslinked polymer product from a graft copolymer of polyethylene and a hydrolysable ethylenically unsaturated silane. The polyethylene and hydrolysable ethylenically unsaturated silane are first reacted together in an extruder in the presence of a peroxide catalyst. The graft copolymer is extruded and granulated and then
10 mixed by tumbling with a masterbatch blend of polyethylene and a silanol condensation catalyst made in a second extrusion step. The resulting blend is finally extruded in a third extrusion step to produce the shaped article. It is possible to carry out this technique using only two, instead of three, extrusions but even then
15 it still involves a relatively large amount of handling and an excessive use of extruder time.

Other patents which disclose processes for the production of graft copolymers of polyolefin and hydrolysable ethylenically unsaturated silane which require two or more extrusion steps include
20 US 3 802 913, US 4 117 063, US 4 136 132 and US 4 228 255. A commercial example of the multi-extrusion process for producing the graft copolymers is the SIOPLAS (Registered Trade Mark) process.

It is difficult, if not impossible, or impractical to produce a graft copolymer by simply mixing together in a conventional extruder
25 a polyolefin, a hydrolysable ethylenically unsaturated silane, a peroxide catalyst and a silanol condensation catalyst. A conventional extruder does not provide adequate mixing and localised premature crosslinking tends to cause gels in the product. However a process for producing a graft copolymer using a
30 single extrusion process is known and is disclosed in US 4 117 195 and US 4 351 790. This process requires the use of a specially designed, complex and expensive extruder which is substantially longer than a conventional extruder. A special extruder screw is required as described in British Patent 964 428. Also the
35 temperatures at various points along the length of the extruder need

to be carefully controlled. The one extrusion process therefore requires the installation of new, specially designed extruders or difficult and expensive adaptations to an existing, conventional extruder. The one-extrusion process is operated commercially as the
5 MONOSIL (Registered Trade Mark) process.

Published European Patent Application No.0 163 865 discloses a method and apparatus for producing shaped crosslinked product from a graft copolymer by extruding compacted molten polymer, e.g. polyethylene, into a mixer formed on or fitted to the discharge end
10 of an extruder, injecting proportionate amounts of a compounding mixture comprising olefinically unsaturated hydrolysable silane, free-radical generator and, preferably, a silanol condensation catalyst into the compacted, molten polymer. The polymer and compounding mixture are blended in the mixer until the silane is
15 grafted to the polymer and the resulting graft copolymer mixed with the silanol condensation catalyst is extruded through a die to form the shaped product. The process disclosed in EP 0 163 865 is therefore an alternative one-extrusion process for grafting hydrolysable ethylenically unsaturated silane onto a polyolefin.

20 The processes for producing crosslinked products by graft copolymerising a polyolefin with a hydrolysable ethylenically unsaturated silane have certain advantages over techniques involving crosslinking by the use of free-radical generators. However, the surface characteristics of products produced from the graft
25 copolymers are generally not very good. The surface defects are generally most noticeable following a change in the speed of the extrusion line; such as, for example, when the speed of a line for coating a cable is increased again following a decrease in line speed to enable lengths of conductor to be joined. The surface
30 characteristics can be important in a number of possible applications of the graft copolymer but the application for which it is most critical is coating wire and cable. A smooth surface is required for good insulation properties. The graft copolymers produced according to the known processes are generally crosslinked
35 by storing them in a steam filled chamber (a "sauna") at 80°C for a

relatively long period of time, typically 8 to 16 hours. British Patents GB2 028 831B and GB 2 039 513B disclose the preparation and use of a crosslinkable polyethylene resin composition comprising (a) a copolymer of ethylene and ethylenically unsaturated silane and (b) a silanol condensation catalyst. The copolymer of ethylene and unsaturated silane is prepared at a temperature of from 150 to 400°C under a pressure of from 1000 to 4000 kg/cm² in the presence of a radical polymerisation initiator.

Copolymers of alpha-olefins with hydrolysable olefinically unsaturated silane compounds (hereinafter referred to, for convenience, as "silane copolymers") such as those disclosed in GB 2 028 831 and GB 2 039 513 can be used in the fabrication of a large variety of useful products. The blends of silane copolymers and silanol condensation catalysts can be handled and processed using apparatus and techniques conventionally used for plastics fabrication. For example, blends of the silane copolymers and silanol condensation catalysts can be subjected to conventional extrusion, injection moulding, blow-moulding and film-blowing processes. Generally, the crosslinking of a silane copolymer is effected subsequent to the shaping process because the crosslinked polymer cannot be satisfactorily thermoformed.

A problem encountered with silane copolymers is that during thermoforming operations, the polymer can undergo premature crosslinking. In addition, extrusion of blends of silane copolymer and silanol condensation catalyst can result in "scorching" of the extruded product. "Scorching" is a term used in the art to describe the formation of surface imperfections due to polymer which has crosslinked in the extruder being deposited on the surface of the extrudate. Premature crosslinking, including "scorching" can lead to difficulties in the fabrication of products or the production of articles having unsatisfactory physical and mechanical properties.

One method of reducing premature crosslinking proposed in British Patent GB-A-1357549 is to mould or extrude articles from silyl modified polymers in the absence of the silanol condensation catalyst and then to contact the produced article with an

aqueous dispersion or solution of a tin carboxylate to cause the crosslinking. However, in many applications it is preferred to include the silanol condensation catalyst as a component of the polymer composition because this generally results in higher crosslinking rates and to more complete crosslinking, particularly in articles having a relatively thick cross section.

It is known to use mixers formed or attached at the discharge ends of extruders. US Patents 4 169 679 and 4 302 409 disclose mixer heads capable of being attached to the discharge end of an existing extruder forwarding screw. The mixer head is disposed in the extruder barrel between the screw and the die and turns with the screw to mix the compacted molten polymer delivered to it by the forwarding screw. A fluid additive, such as a blowing agent, can be introduced through the barrel wall to the compacted, molten polymer at the upstream end of the mixer head. Neither of these patents teaches or suggests the addition of a silanol condensation catalyst to a silane copolymer in order to produce a crosslinkable composition.

US Patents 2 540 146 and 3 035 303 disclose the use of mixing heads constructed at the downstream end of an extruder screw upstream from the extrusion die. These patents do not disclose the provision of a separate mixer head adapted to be attached to an existing extruder or the production of a crosslinkable polymer composition comprising a silane copolymer and a silanol condensation catalyst.

Mixer units adapted to be fitted onto existing extruders are known. For example, a cavity-transfer type extruder mixer is disclosed in British Patent 930 339 which comprises a hollow cylindrical stator member and a cylindrical rotor member which is rotatable within the stator. The facing surfaces on the rotor and stator carry respective pluralities of rows of elongate longitudinally extending grooves. The rows of grooves on each member extend circumferentially around the member and are spaced apart axially, the rows of one member being axially offset from the rows on the other member such that there is axial overlap of the

grooves in adjacent rows on the stator and rotor. European Patent 0 048 590 discloses an improved cavity-transfer mixer in which the facing surfaces of the stator and rotor are each provided with circumferentially extending rows of cavities, the cavities in adjacent rows on the stator being circumferentially offset; the cavities in adjacent rows on the rotor being circumferentially offset; and the rows of cavities on the stator and rotor being axially offset. British patent 1 475 216 discloses a mixer head which can be adapted to be fitted onto existing extruders in which the mixer head has grooves and lands on the facing surfaces of the rotor and stator. None of these patents teaches or suggests the production of a crosslinkable composition comprising a blend of a silane copolymer and a silanol condensation catalyst.

An object of the present invention is to provide an improved process for producing shaped, extruded product from a crosslinkable silane copolymer. In particular, it is an object of the present invention to provide a process for producing shaped, extruded product from a crosslinkable silane copolymer which process overcomes or at least mitigates the problems of precuring, including "scorching" often experienced with the known processes.

A further object of the present invention, at least in its preferred embodiments, is to provide a process for producing shaped, extruded product from a silane copolymer which can be crosslinked in a relatively short period of time at moderate temperatures.

According to the present invention a process for producing a shaped, extruded product from a crosslinkable copolymer of an alpha-olefin with a hydrolysable, ethylenically unsaturated silane compound comprises:

- (A) introducing the copolymer into the feed zone of an extruder;
- (B) compacting and melting the copolymer in the extruder;
- (C) passing the compacted, molten copolymer through a distributive mixer positioned at the discharge end of the extruder;
- (D) injecting a silanol condensation catalyst into the compacted, molten copolymer after compacting and melting in the extruder;

- (E) blending the compacted, molten copolymer and the silanol condensation catalyst in the distributive mixer and
(F) extruding the resulting blend out of the distributive mixer through an extrusion die to form a shaped, crosslinkable, extruded product.

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The shaped, extruded product is crosslinked by exposure to H₂O. The crosslinking can be effected by simply storing the product, storing in a humid atmosphere or by treating the product with water or steam. For example, the shaped, extruded product can be passed through a water bath, sprayed with water or stored in a steam filled cabinet.

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Shaped, extruded products formed from blends comprising (A) silyl-modified polymers i.e. silane copolymers (as hereinbefore defined) or polyolefins grafted with hydrolysable ethylenically unsaturated silane and (B) silanol condensation catalysts are commonly crosslinked by placing the product in a steam-filled chamber (a "sauna") maintained at an elevated temperature, typically 80°C, for a period of time which is typically from 8 to 16 hours. It is a feature of the present invention that shaped products can be formed from blends of silane copolymer and silanol condensation catalyst which can be crosslinked in a relatively short period of time at moderate temperature e.g. 24 hours at 20°C. The improved rate of crosslinking which is obtainable by using the process according to the present invention offers the possibility of "in-line curing" i.e. manufacturing and curing the product on a single processing line such that the product at the end of the line is adequately crosslinked and requires no further treatment. The possibility of "in-line curing" would be especially advantageous in the manufacture of wire and cable coated with crosslinked silane copolymers.

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The silane copolymer can be prepared using known techniques and equipment and is preferably a copolymer of ethylene with a hydrolysable ethylenically unsaturated silane compound.

The unsaturated silane compound copolymerised with the alpha-olefin is preferably a compound having the general formula,

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$R^1SiR^2_mY_{3-m}$ wherein R^1 represents an ethylenically unsaturated hydrocarbyl or hydrocarbyloxy group; R^2 represents an aliphatic saturated hydrocarbyl group; Y represents a hydrolysable organic group and m is 0, 1 or 2. If the compound has more than one Y, they
 5 need not be the same. More specific examples of suitable hydrolysable ethylenically unsaturated silane compounds having the above general formula are those in which R^1 is vinyl, allyl isopropenyl, butenyl, cyclohexenyl or methacryloxypropyl; Y is methoxy, ethoxy, formyloxy, acetoxy, propionyloxy, alkylamino or
 10 arylamino; and R^2 is methyl, ethyl, propyl, decyl or phenyl.

Particularly suitable unsaturated silane compounds suitable for use in the present invention are those having the general formula $CH_2=CHSi(OZ)_3$ wherein Z is a hydrocarbyl group having 1 to 8 carbon atoms, preferably 1 to 4 carbon atoms. Most preferably, the
 15 unsaturated silane is selected from the group consisting of vinyl trimethoxysilane, vinyl triethoxysilane and vinyl triacetoxy silane.

The silane copolymer preferably contains from 0.1 to 10% by weight, more preferably 0.5 to 5% by weight of copolymerised units of the silane compound.

20 In addition to the alpha-olefin and hydrolysable ethylenically unsaturated silane, the silane copolymer can optionally contain one or more further comonomers. The further comonomers can be selected from various monomers which are copolymerisable with the alpha-olefin and hydrolysable ethylenically unsaturated silane
 25 compound and which are, in addition, compatible with the unsaturated silane and the crosslinking reaction. Suitable further comonomers include vinyl esters, alkyl (meth) acrylates, unsaturated ethers, unsaturated carboxylic acids and derivatives of (meth) acrylic acid. Generally, the silane copolymer will contain less than 40,
 30 preferably less than 30 per cent by weight of the further comonomer. Most preferably, the further comonomer, if present, is used in an amount of from 1 to 20 per cent by weight of the total weight of the silane copolymer.

Silanol condensation catalysts suitable for use in crosslinking
 35 c polymers containing hydrolysable silane are known and include

metal carboxylates, organic bases, inorganic acids and organic acids. Specific examples of suitable silanol condensation catalysts are dibutyl tin dilaurate, dibutyl tin diacetate, dibutyl tin dioctoate, stannous acetate, stannous caprylate, lead naphthenate, zinc caprylate, cobalt naphthenate, ethylamines, dibutylamine, 5 hexylamines, pyridine, sulphuric acid, hydrochloric acid, toluenesulphonic acid, acetic acid, stearic acid and maleic acid. The preferred silanol condensation catalysts are the tin carboxylates, particularly dibutyl tin dilaurate. The amount of 10 silanol condensation catalyst introduced into the compacted, molten copolymer will depend on the selected catalyst and the copolymer to be crosslinked. The optimum quantity can readily be determined by a person skilled in the art using simple experiments. In general, the amount of silanol condensation catalyst used will be from 0.01 to 10 15 per cent by weight of the silane copolymer, preferably from 0.05 to 3 per cent by weight.

The amount of silanol condensation catalyst used in the known commercial processes is typically about 0.05% by weight of the silane copolymer whereas the amount used in the process according to 20 the present invention is preferably at least 0.3% by weight of the silane copolymer.

Other additives can be included in the compositions prepared according to the process of the present invention such as antioxidants and heat stabilisers commonly used in the processing of 25 polyolefins. The compositions can also include fillers for example, minerals for improving flame retardancy or providing water for the crosslinking reaction e.g. metal hydroxides such as aluminium hydroxide and magnesium hydroxide or minerals such as electrically conductive carbon black, chalk, talc, mica and silica. The 30 additives and fillers can be included with the silane copolymer fed into the extruder, can be introduced at the upstream end of the distributive mixer, either separately from or together with the silanol condensation catalyst, or can be mixed using a further mixing unit, with the blend of silane copolymer and silanol 35 condensation catalyst leaving the distributive mixer before the

composition is extruded to form a shaped product. Preferably, the additives are introduced into the distributive mixer with the silanol condensation catalyst.

5 The compositions prepared according to the process of the present invention can also contain other polymers, thermoplastics or elastomers.

Known equipment can be used to carry out the method according to the present invention. The extruder can be any conventional extruder comprising a hollow barrel and a forwarding screw
10 rotatably mounted in the barrel. Generally the ratio of the length to diameter of the extruder screw is about 15:1 to 25:1.

The distributive mixer is preferably of the cavity-transfer type disclosed in British patents 930 339 and 1 475 216 and European patent 0 048 590. Such mixers provide rapid mixing of the silanol
15 condensation catalyst with the silane copolymer and are readily fitted onto conventional extruders.

The method according to the present invention is suitable for producing various products by extrusion, such as, for example, coatings for wire and cable, foam, film, sheets, rods and pipes. It
20 is to be noted that the term extrusion as used in this specification includes blow moulding and injection moulding processes.

The present invention is particularly useful for the coating of wires and cables and includes a process for producing wire and
25 cable coated with a crosslinked copolymer of an alpha-olefin preferably ethylene, and a hydrolysable, ethylenically unsaturated silane compound which process comprises:

- (A) introducing the copolymer into the feed zone of an extruder;
- 30 (B) compacting and melting the copolymer in the extruder;
- (C) passing the compacted, molten copolymer through a distributive mixer positioned at the discharge end of the extruder;
- 35 (D) injecting a silanol condensation catalyst into the compacted, molten copolymer after compacting and melting

in the extruder;

- (E) blending the compacted, molten copolymer and the silanol condensation catalyst in the distributive mixer;
- (F) extruding the resulting blend out of the distributive mixer through an extrusion die to form a coating about an electrical conductor, wire or cable and
- (G) crosslinking the coated electrical conductor by exposure to H₂O.

If the process is to use "in-line curing", the silane copolymer can be crosslinked, for example, by drawing the coated electrical conductor, wire or cable through a trough filled with hot water, the trough being of sufficient length that the silane copolymer is adequately crosslinked by the time the coated product is drawn from the downstream end of the trough.

The invention will now be described with reference to the accompanying drawings Figures 1 to 4.

Figure 1 is a diagrammatic representation of a longitudinal section of a conventional extruder fitted with a cavity-transfer mixer and provided with means for injecting a silanol condensation catalyst.

Figure 2 is an enlarged transverse section through the rotor of the cavity transfer mixer taken along the line 21 - 21 in Figure 1.

Figure 3 is an enlarged transverse section through the stator of the cavity transfer mixer taken along the line 20 - 20 in Figure 1.

Figure 4 is a developed view of part of the rotor and stator of the cavity transfer mixer illustrating the offset of the rows of cavities on the facing surfaces of the rotor and stator.

The extruder (1) shown in Figure 1 is a conventional extruder comprising a feed hopper (2), a barrel (3) and a forwarding screw (4). The extruder has the usual three processing zones; the feed zone (5); the compression-melting zone (6); and the metering zone (7). Cooling means (8) are provided at the upstream end of the extruder and along the barrel of the extruder (9).

Attached at the downstream end of the extruder is a

distributive mixer (10) of the cavity-transfer type as described in European patent EP048 590. The disclosure of which is incorporated herein by reference. The mixer (10) comprises a stator (11) bolted to the barrel (3) of the extruder (1) and a rotor (12) attached to the forwarding screw (4). The rotor (12) can be attached to the forwarding screw (4) by any convenient means, such as by screw threads (not shown) so that it rotates with the screw.

A crosshead (13) is attached to the downstream end of the mixer (10) by any suitable means e.g. a clamp or bolts (14). Heating units (15) can be provided around the stator (11) and crosshead (13).

Means (16) are provided for injecting the silanol condensation catalyst into the upstream part of the mixer (10). Any suitable means (16) for injecting the silanol condensation catalyst into the compacted, molten silane copolymer entering the mixer can be used. Generally the injection means (16) will comprise a reservoir (17) a pump (18) and a non-return valve (19).

The facing surfaces of the stator (11) and rotor (12) of the mixer (10) have pluralities of rows of or biradial cavities (22, 23). These cavities are shown in more detail in Figures 2, 3 and 4. The cavities (23) on the rotor (12) and the cavities (22) on the stator (11) are arranged in circumferential rows.

The invention is illustrated by the following example.

Example

The apparatus used in the example comprised a single screw extruder, a distributive mixer fitted at the discharge end of the extruder, means for introducing liquid components, including a silanol condensation catalyst, into the upstream portion of the mixer and a die capable of coating an electrical conductor.

The extruder used was manufactured by Nokia Cable Machinery and sold under the trade designation MP80-24D fitted with a low compression metering screw.

The distributive mixer used was a cavity-transfer mixer of the type disclosed in European patent 0 048 590. but having the shape

and distribution of cavities illustrated in Figures 2 to 4.

The silane copolymer used was prepared by copolymerising ethylene and vinyl trimethoxysilane in a tubular reactor to produce a copolymer having a silane content of about 1.5% by weight of the total weight of the silane copolymer. The silane copolymer had a density of 0.925g/cm³(ISO/1872/1-1986) and a melt index of 0.5dg/min (ISO/1133 1981 (E) Condition 4).

The silane copolymer was loaded into the hopper of the extruder together with an antioxidant masterbatch. The antioxidant masterbatch comprised 95 parts by weight of high pressure, low density polyethylene and 5 parts by weight of a commercial antioxidant which is polymerised 2, 2, 4-trimethyl-1, 2-dihydroquinolene. The amount of the antioxidant masterbatch used was about 5 parts by weight per hundred parts by weight of the silane copolymer.

The silanol condensation catalyst used was dibutyl tin dilaurate.

The mixture of silane copolymer and antioxidant masterbatch was compacted and melted in the extruder. The compacted molten polymer composition was passed through the cavity transfer mixer into which the silanol condensation catalyst was injected. The quantity of silanol condensation catalyst injected into the upstream portion of the mixer was about 0.4% by weight of the silane copolymer. The polymer mixture and silanol condensation catalyst were blended together in the mixer and extruded through the die to form a substantially cylindrical coating about a 2.14mm diameter copper wire. The coating was about 1.7mm thick. Typically, the insulation layer for a low voltage wire of 2.14mm diameter is about 0.8mm and so the coating used in this experiment was substantially thicker than would normally have been used on such a wire. The coated wire was then drawn through a conventional cooling trough filled with water.

The coating was stripped from the wire and samples were crosslinked by (A) immersing in water at about 20°C for 24 hours; (B) immersing in water at about 20°C for 96 hours; and (C) storing

at room temperature and humidity for 168 hours.

The crosslinked samples were then subjected to the test method disclosed in IEC540 (20N/cm², 15 mins, 200°C) in order to determine their heat elongation. The IEC 540 specification requires that the coating composition should have a heat elongation of less than 175%. All of the samples satisfied this requirement. The samples subjected to curing conditions A had a heat elongation of about 125%, the samples subjected to curing conditions B had a heat elongation of about 55% and the samples subjected to curing conditions C had a heat elongation of 100%. These results are considered to be particularly good in view of the fact that the coating was substantially thicker than would normally have been used on a 2.14mm diameter wire.

Claims:

1. A process for producing a shaped, extruded product from a crosslinkable copolymer of an alpha-olefin with a hydrolysable ethylenically unsaturated silane compound which process comprises:
 - (A) introducing the copolymer into the feed zone of an extruder;
 - 5 (B) compacting and melting the copolymer in the extruder;
 - (C) passing the compacted, molten copolymer through a distributive mixer positioned at the discharge end of the extruder;
 - (D) injecting a silanol condensation catalyst into the compacted, molten copolymer after compacting and melting in the extruder;
 - 10 (E) blending the compacted, molten copolymer and the silanol condensation catalyst in the distributive mixer and
 - (F) extruding the resulting blend out of the distributive mixer through an extrusion die to form a shaped, crosslinkable, extruded product.
- 15 2. A process as claimed in claim 1 in which the shaped, crosslinkable, extruded product is crosslinked by exposure to H₂O
3. A process as claimed in either claim 1 or claim 2 in which the copolymer of an alpha-olefin with a hydrolysable ethylenically unsaturated silane compound comprises ethylene as the alpha-olefin.
- 20 4. A process as claimed in any one of claims 1 to 3 in which the copolymer comprises vinyltrimethoxysilane, vinyltriethoxysilane or vinyl triacetoxysilane as the hydrolysable ethylenically unsaturated silane compound.

5. A process as claimed in any one of claims 1 to 4 in which the copolymer comprises 0.5 to 5 weight per cent of silane.

6. A process as claimed in any one of claims 1 to 5 in which the silanol condensation catalyst is dibutyltin dilaurate.

5 7. A process as claimed in any one of claims 1 to 5 in which the distributive mixer comprises a hollow stator, a rotor journaled for rotation within the stator, the facing surfaces of the rotor and stator having respective mixing elements such that the compacted, molten copolymer is subjected to rapid distributive mixing action as
10 it passes through the mixer and the silanol condensation catalyst is dispersed in the compacted, molten copolymer to produce a substantially homogeneous blend.

8. A process as claimed in claim 7 in which the mixing elements are hemispherical or biradial cavities.

15 9. A process for producing electrical conductors, wire or cable coated with a crosslinked copolymer of an alpha-olefin and a hydrolysable ethylenically unsaturated silane compound comprising:

- (A) introducing the copolymer into the feed zone of an extruder;
- 20 (B) compacting and melting the copolymer in the extruder;
- (C) passing the compacted, molten copolymer through a distributive mixer positioned at the discharge end of the extruder;
- (D) injecting a silanol condensation catalyst into the
25 compacted, molten copolymer after compacting and melting in the extruder;
- (E) blending the compacted, molten copolymer and the silanol condensation catalyst in the distributive mixer and
- (F) extruding the resulting blend out of the distributive
30 mixer through an extrusion die to form a coating about an electrical conductor, wire or cable and
- (G) crosslinking the coated electrical conductor by exposure to H₂O

10. A shaped extruded product produced according to the process as
35 claimed in claim 1.

11. A wire or cable produced according to the process as claimed in claim 9.

12. A process substantially as described with reference to the Example.

5 13. A process substantially as described with reference to the accompanying drawings.

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